

**Amendments to the Claims:**

This listing of claims will replace all prior versions, and listings, of claims in the application:

**Listing of Claims:**

1. (Canceled)
2. (Currently amended): A digital telemetry system having improved data rate and robustness, comprising:

a data transmission cable having a first end and a second end, and capable of transmitting data on at least two propagation modes;

a data source connected at the first end and having data transmission circuitry to generate data signals on the at least two propagation modes;

a receiver connected to the second end whereon the receiver receives signals on a first and second of at least two propagation modes and having

a processor connected to a storage medium storing instructions directing the processor to execute

an adaptive far-end cross-talk cancellation logic for canceling cross-talk that occurs between the first and second propagation modes, -wherein the adaptive far-end cross-talk cancellation logic comprises

a first propagation mode cross-talk adjustment logic to direct the processor to receive samples on a the first propagation mode and having a second propagation mode cross-talk adjustment logic to direct the processor to accept samples from a the second propagation mode wherein the first propagation mode cross-talk adjustment logic directs the processor to adjust

the samples on the first propagation mode by values that are a function of the samples of the second propagation mode; and

further comprises instructions to cause the processor to

determine a slice residual from the output of ~~the~~ each of the first and second mode cross-talk adjustment logics; and

update a cross-talk parameter from the slice residual.

3. (Canceled)

4. (Currently amended): The digital telemetry system of Claim 2, wherein the adaptive far-end ~~adaptive~~ cross-talk cancellation logic causes the processor to accept as input one value on each of a plurality of carriers and to compute the cross-talk component for each carrier.

5. (Currently amended): The digital telemetry system of Claim 4, wherein the adaptive far-end ~~adaptive~~ cross-talk cancellation logic directs the processor to compute the cross-talk component for each carrier by multiplying the signal received on the second propagation mode by a carrier specific coefficient.

6. (Currently amended): The digital telemetry system of Claim 5, further comprising ~~wherein a~~ far-end cross-talk parameter update logic ~~directs~~ directing the processor to update each carrier specific coefficient as a function of the slice residual on such carrier.

7. (Currently amended): A digital telemetry system having improved data rate and robustness, comprising:

a data transmission cable having a first end and a second end, and capable of transmitting data on at least two propagation modes;

a data source connected at the first end and having data transmission circuitry to generate data signals on the at least two propagation modes;

a receiver connected to the second end whereon the receiver receives signals on a first and second of at least two propagation modes and having

a processor connected to a storage medium storing instructions directing the processor to execute

an adaptive far-end cross-talk cancellation logic for canceling cross-talk that occurs between the first and second propagation modes,

wherein the adaptive far-end cross-talk cancellation logic comprises a first propagation mode cross-talk adjustment logic to direct the processor to receive samples on a first frequency domain equalizer on the first propagation mode and having a second propagation mode cross-talk adjustment logic to direct the processor to accept samples to a second frequency domain equalizer from a the second propagation mode wherein the first propagation mode cross-talk adjustment logic directs the processor to adjust the samples on the first propagation mode by values that are a function of the samples of the second propagation mode, and

~~further~~ wherein the far-end adaptive cross-talk cancellation logic causes the processor to accept as input one value on each of a plurality of carriers to a far-end cross-talk determination circuit and to compute the cross-talk component for each carrier by multiplying the signal received on the second propagation mode by a carrier specific coefficient for the far-end cross-talk determination circuit and to update each carrier specific coefficient by applying the ~~equation~~ following:

$$CXY_i = CXY_i +$$

$$AlphaFEXT * (< CEX_i, CEX_i > / REF\_MAGN^2) * < TXFFT\_out[i], TYresidual[i] >$$

where

CEXi is the frequency domain equalizer coefficient of the first frequency domain equalizer for the ith carrier of propagation mode X;

CXYi is the carrier specific coefficient for the far-end determination circuit for ~~cross-talk cancellation coefficient for the ith carrier for~~ cancelling far-end cross-talk from the first propagation mode X to the second propagation mode Y;

AlphaFEXT is a constant for balancing the tracking speed of CXYi against the stability of the value of CXYi;

REF\_MAGN is the Root Means Square (RMS) magnitude of CEXi;

TXFFT\_out[i] is the frequency domain data point of the received sample on the ith carrier on propagation mode X;

TYresidual[i] is the slice residual for the ith data point on the Y propagation mode; and

$\langle \rangle$  is a complex scalar product defined as  $\langle a+jb, c+jd \rangle = (a-jb)*(c+jd) = (ac+bd)+j(ad-bc)$ .

8. (Currently amended): The digital telemetry system of Claim 2, wherein the ~~far-end~~ first propagation mode cross-talk adjustment logic directs the processor to receive  $m$  samples from the second propagation mode and convolve ~~these~~ the  $m$  samples using  $m$  coefficients.

9. (Currently amended): The digital telemetry system of Claim 8, wherein the storage medium further stores instructions comprising ~~the~~ a slice determination logic and a coefficient update logic directing the processor to adjust the  $m$  coefficients as a function of ~~a~~ the slice residual determined by the slice determination logic.

10. (Currently amended): A digital telemetry system having improved data rate and robustness, comprising:

a data transmission cable having a first end and a second end, and capable of transmitting data on at least two propagation modes;

a data source connected at the first end and having data transmission circuitry to generate data signals on the at least two propagation modes;

a receiver connected to the second end whereon the receiver receives signals on a first and second of at least two propagation modes and having

a processor connected to a storage medium storing instructions directing the processor to execute

an adaptive far-end cross-talk cancellation logic for canceling cross-talk that occurs between the first and second propagation modes, the adaptive far-end cross-talk cancellation logic comprising a first propagation mode cross-talk adjustment logic to direct the processor to receive samples to a first linear adaptive equalizer on a first propagation mode and having a second propagation mode cross-talk adjustment logic to direct the processor to accept samples to a second linear adaptive equalizer from ~~a~~ the second propagation mode wherein the first propagation mode cross-talk adjustment logic directs the processor to adjust the samples on the first propagation mode by values that are a function of the samples of the second propagation mode,

wherein the ~~far-end~~ first propagation mode cross-talk adjustment logic directs the processor to receive  $m$  samples to a linear adaptive cross-talk determination logic from the second propagation mode and convolve ~~these~~ the  $m$  samples using  $m$  coefficients and the storage medium further stores instructions comprising a slice determination logic and a coefficient update logic directing the processor to adjust the  $m$  coefficients as a function of a slice residual determined by the slice determination logic using the ~~equation~~ following:

$CXY_i = CXY_i +$   
 $AlphaFEXT * (< CEX_i, CEX_i > / REF\_MAGN^2) * < TY_{(n-i)}, TX_{residual} >$  where,

$CEX_i$  is the  $i$ th time domain equalizer coefficient of the first linear adaptive equalizer of the first propagation mode X;

$CXY_i$  is ~~the an  $i$ th coefficient cross-talk cancellation coefficient~~ for canceling far-end cross-talk of the linear adaptive cross-talk determination logic from the first propagation mode X onto the second propagation mode Y;

$TY_{(n-i)}$  is the  $(n-i)$ th sample from the second propagation mode Y;

$TX_{residual}$  is  $TX_{Corr} - TX_{IdealPoint}$

where  $TX_{Corr}$  is the cross-talk corrected output from ~~the cross-talk adjustment logic~~ a summer and  $TX_{IdealPoint}$  is an ideal constellation point for the first propagation mode X; and

$AlphaFEXT$  is a constant between 0 and 1;

$REF\_MAGN$  is the Root Means Square (RMS) magnitude of  $CEX_i$ ;

and

$< >$  is a complex scalar product defined as  $< a+jb, c+jd > = (a-jb)*(c+jd) = (ac+bd)+j(ad-bc)$ .

11. (Currently amended): The digital telemetry system of Claim 10, wherein  $AlphaFEXT$  is in the range from 0.00001 to 0.001.

12. (Canceled)

13. (Canceled)

14. (Canceled)

15. (Currently amended) A method of digital telemetry having improved data rate and robustness by canceling far-end cross-talk from a near-lying propagation mode, comprising:

inputting a first sample received on a first propagation mode to a first frequency domain equalizer;

inputting a second sample received on a second propagation mode to a second frequency domain equalizer;

determining a slice residual;

determining a cross-talk component from the second sample on the first sample ;

adjusting a function used to determine the cross-talk component of a far-end cross-talk determination circuit as a function of the slice residual; and

determining an output by subtracting the cross-talk component from the second sample from the first sample, wherein the cross-talk component is determined by multiplying a carrier specific coefficient with a sample received on a corresponding carrier on the near-lying propagation mode and the coefficients is updated by applying the ~~function~~ following:

$$CXYi = CXYi + \text{AlphaFEXT} * (< CEXi, CEXi > / \text{REF\_MAGN}^2) * < \text{TXFFT\_out}[i], \text{TYresidual}[i] >$$

where

CEXi is the frequency domain equalizer carrier for the ith carrier of the first propagation mode X;

CXYi is the carrier specific coefficient for the far-end cross-talk determination circuit ~~cross-talk cancellation coefficient for the ith carrier~~ for canceling far-end cross-talk from the first propagation mode X to the second propagation mode Y;

AlphaFEXT is a constant for balancing the tracking speed of CXYi against the stability of the value of CXYi;

REF\_MAGN is the Root Means Square (RMS) magnitude of ~~magnitude of~~ CEXi;

TXFFT\_out[i] is the frequency domain data point on the ith carrier of the first propagation mode X;

TYresidual[i] is the slice residual for the ith data point on the second ~~Y~~ propagation mode Y; and

$\langle \rangle$  is a complex scalar product defined as  $\langle a+jb, c+jd \rangle = (a-jb)*(c+jd) = (ac+bd)+j(ad-bc)$ .

16. (Canceled)

17. (Canceled)

18. (Canceled)

19. (Currently amended) A method of digital telemetry having improved data rate or robustness by canceling far-end cross-talk from a near-lying propagation mode, comprising:

inputting a first set of samples received on a first propagation mode to a first linear adaptive equalizer;

inputting a second set of samples received on a second propagation mode to a second linear adaptive equalizer;

determining a cross-talk component by convolving the second set of samples, convolving comprising multiplying each sample in the second set of samples by a coefficient;

determining an output by subtracting the cross-talk component of a linear adaptive cross-talk determination logic from a first set of samples on the first propagation mode;



determining a slice residual between the output and an ideal point; and  
adjusting the coefficients as a function of the slice residual by applying the  
equation following:

$$CXY_i = CXY_i + \text{AlphaFEXT} * (< CEX_i, CEX_i > / \text{REF\_MAGN}^2) * < TY_{(n-i)}, TX_{\text{residual}} > \quad \text{where,}$$

CEX<sub>i</sub> is the i<sup>th</sup> time domain equalizer coefficient for the first propagation mode X;

TY<sub>(n-i)</sub> is the (n-i) set of samples from the second propagation mode Y;

TX<sub>residual</sub> is TX<sub>Corr</sub> - TX<sub>IdealPoint</sub>

where TX<sub>Corr</sub> is the cross-talk corrected output from the ~~cross talk adjustment circuit~~ a summer and TX<sub>IdealPoint</sub> is an ideal constellation point for the first propagation mode X;

AlphaFEXT is a constant between 0 and 1; and

< > is a complex scalar product defined as <a+jb, c+jd>=(a-jb)\*(c+jd)=(ac+bd)+j(ad-bc).

20. (Currently amended): The method of Claim 19 wherein AlphFEXT is in the range from 0.00001 to 0.001.